

VOICE CALLER ID

INVENTORS

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BACKGROUND

Technical Field

[0001] The invention relates generally to telephones and more particularly to audibly annunciating information at a telephone or in proximity of a telephone.

Description of the Related Art

[0002] Caller Identification (hereinafter "caller ID") is a feature provided by local phone companies that sends information from the telephone network to a telephone device between the first and second rings. The information that is sent varies. It generally includes, however, the calling telephone number and the name of the caller. This information is sent via the telephone line in a digital data packet that is usually Frequency Shift Keyed (hereinafter "FSK") modulated. At the receiving telephone device the subscriber must be signed up for the caller ID service and must have a caller ID data receiver, i.e., a caller ID unit, connected to the telephone line in order to receive the digital data packet containing the caller ID information for the calling telephone device. The data receiver receives the FSK modulated digital data packet and provides a visual display of the information. In operation, the caller ID unit receives the FSK modulated digital data packet, demodulates it and converts the information into a stream of text characters that is then displayed, for example, on a liquid crystal display (LCD) provided either on the caller ID unit or which is integral to the telephone device itself. As discussed before, for an incoming call, the caller ID information that is displayed at the receiving side can include the

name and number of the calling party among other types of information. The central office must have "caller ID capability" and the service must be enabled within the central office of the local telephone exchange. If, however, the central office does not have caller ID capability, the called party will receive a variety of messages including, for example, "out of area."

[0003] Among the information that is displayed on the caller ID unit is the originating telephone number and the name listed in the directory under that number. In other words, the name that is displayed is the name that the telephone company has entered into a database and believes to be that of its customer. The number in the local central office database also aids another database lookup and thus associates the name in the directory with the number from where the call originates. The calling party's name and number information is transmitted through the central office and the telecommunication network and ultimately is displayed at the caller ID unit or on the telephone device itself. As discussed hereinbefore, such caller ID information is generally transmitted and displayed between the first and second rings. For caller ID to work properly in a telecommunication environment, the telecommunication network switches must be supported by Common Channel Signaling (CCS) and the party initiating the call must originate it from a single-channel line, a multi-channel trunk line with ANI/Calling Party ID. Further, if the originating line or caller blocks the transmission of the caller ID information, the receiving party will not be able to view the information or the receiving device will display, for example, "ANONYMOUS," "NOT AVAILABLE" or "PRIVATE CALLER."

[0004] Now turning to Fig. 1, one example of a caller ID system 10 is illustrated generally. The system 10 includes a calling telephone device 12 connected to a first central office switch 18 that originates a call to a first receiving telephone device 14 connected to a second central office switch 20. The call propagates through a telecommunication network 16 that provides a connection between the first central office switch 18 and the second central office switch 20. The receiving telephone device 14 includes a conventional caller ID unit 22 that is separate and detached from the telephone device 14.

[0005] Fig. 2 illustrates one embodiment of a conventional caller ID unit 22. The caller ID unit 22 can include, for example, a telephone line interface circuit 36, a demodulator circuit 38, a control circuit 40 and an alphanumeric display 42. The control circuit 40 can be a single chip computer or can be implemented using discrete integrated circuits depending on the specific application. The control circuit 40 includes, in the most general sense, a microprocessor 44, a memory circuit 46 and a read only memory circuit 48 (ROM). The control circuit 40 also includes a universal asynchronous receiver transmitter 52 (UART) and a baud rate generator 53. Also included are an address bus 50 and a data bus 54 for interconnecting the various units as shown and an address decoder 49 for selecting various peripheral devices that the control circuit 40 interfaces with such as, for example, the alphanumeric display 42.

[0006] In operation the caller ID unit 22 receives FSK modulated caller ID signals during an interval between intermittent ringing signals from the central office switch 20. The FSK modulated caller ID signals contain, for example, a channel seizure stream that is followed by a mark stream and then the actual caller ID information. The caller ID information can be sent in a Single Data Message Format (hereinafter "SDMF") containing the calling number or in a Multiple Data Message Format (hereinafter "MDMF") containing the calling number and the name associated with that number. The number and name fields may contain additional data to indicate that the caller has blocked the information or that the information is not available. The additional data includes, for example, single bit markers that are interpreted for display.

[0007] The FSK modulated caller ID signals are received at the tip 32 and ring 34 side of the telephone line. These signals are then passed through the telephone line interface circuit 36 where they are filtered and amplified. The filtered and amplified signals are then coupled to the FSK demodulator circuit 38 where the modulated signals are converted to a serial bit stream representation of the caller ID data message. The serial bit stream is then fed to the UART 52, which converts the serial bit stream into a parallel bit format. The parallel bit formatted stream is interpreted as a series of characters comprising the caller ID information data by the

microprocessor 44. The microprocessor 44 then periodically updates the alphanumeric display 42 with each character comprising the parallel bit formatted stream. For additional information regarding the caller ID unit 22, reference is made to US Patent No. 4,582,956 to Doughty, which is herein incorporated by reference in its entirety.

[0008] Over the years the value of the caller ID unit 22 has been shadowed by the fact that the caller ID information is only provided to the recipient in the form of a visual display. The visual display of the caller ID information has much less value to the recipient if he or she happens to be out of the immediate vicinity of the display. For example, if the recipient is in another room and the telephone rings, the recipient must first locate the caller ID unit 22 before he or she can identify the caller. To address this need, several talking caller ID devices exist. Such devices, however, are not an integral part of the telephone and thus add to the number of appliances a user has to purchase and maintain. The talking caller ID devices do not provide a real-time announcement of the caller ID information and rely mainly on prerecorded messages and pre-stored information such as known telephone numbers. Furthermore, the talking caller ID devices do not provide a telephone ring signal capturing function such that the telephone remains silent until the talking caller ID device has received an entire caller ID information stream.

[0009] Therefore, there is a need in the art for an apparatus, system and method for communicating the caller ID information to a recipient in a format other than a visual display that is provided as an integral part of a telephone device. There is also a need to provide the caller ID information in a real-time format as the information is transmitted from the caller without relying on prerecorded messages and pre-stored information such as known telephone numbers. Furthermore, there is a need in the art for a telephone ring signal capturing function such that the caller ID device captures and holds the telephone ring signals until an entire caller ID information stream has been received.

SUMMARY

[0010] According to one aspect, the invention provides an apparatus for audibly annunciating at a device information transmitted over a telephone network, the information being transmitted in the form of a modulated signal to the device wherein the modulated signal is representative of the information. The apparatus includes a receiver for capturing a ring signal and a modulated signal representative of information transmitted over a telephone network during an interval between the ring signal and a subsequent ring signal; a converter in communication with the receiver for converting the modulated signal into a stream of audible signals; and a speaker in communication with the converter for producing audible sounds corresponding to the stream of audible signals representative of the information received over the telephone network.

[0011] Another aspect of the invention provides a telephone. The telephone includes an apparatus for audibly annunciating at a device information transmitted over a telephone network, the information being transmitted in the form of a modulated signal to the device wherein the modulated signal is representative of the information. The apparatus includes a receiver for receiving a modulated signal representative of information transmitted over a telephone network during an interval between ringing signals; a converter in communication with the receiver for converting the modulated signal into a stream of audible signals; and a speaker in communication with the converter for producing audible sounds corresponding to the stream of audible signals representative of the information received over the telephone network.

[0012] A further aspect of the invention provides a method for audibly annunciating at a device information transmitted over a telephone network, the information being transmitted in the form of a modulated signal to the device wherein the modulated signal is representative of the information. The method includes receiving a modulated signal representative of information transmitted over a telephone network during an interval between the ring signal and a subsequent ring signal; converting the modulated signal into a stream of audible signals; and

providing the stream of audible signals to a speaker in communication with the converter for producing audible sounds corresponding to the stream of audible signals representative of the information received over the telephone network.

[0013] Yet another aspect of the invention provides an apparatus for audibly annunciating at a device information transmitted over a telephone network, the information being transmitted in the form of a modulated signal to the device wherein the modulated signal is representative of the information. The apparatus includes means for capturing a ring signal and a modulated signal representative of information transmitted over a telephone network during an interval between the ring signal and a subsequent ring signal; means for converting the modulated signal into a stream of audible signals in communication with the means for capturing; and means for producing audible sounds corresponding to the stream of audible signals representative of the information received over the telephone network in communication with the converter.

[0014] Still another aspect of the invention provides a telephone. The telephone includes means for audibly annunciating at a device information transmitted over a telephone network, the information being transmitted in the form of a modulated signal to the device wherein the modulated signal is representative of the information. The means for audibly annunciating includes means for receiving a modulated signal representative of information transmitted over a telephone network during an interval between ringing signals; means for converting the modulated signal into a stream of audible signals in communication with the means for receiving; and means for producing audible sounds corresponding to the stream of audible signals representative of the information received over the telephone network in communication with the converter.

[0015] Yet a further aspect of the invention provides a system for audibly annunciating at a device information transmitted over a telephone network, the information being transmitted in the form of a modulated signal to the device wherein the modulated signal is representative of

the information. The system includes means for capturing at a receiver a ring signal from a telephone network; means for receiving a modulated signal representative of information transmitted over a telephone network during an interval between the ring signal and a subsequent ring signal; means for converting the modulated signal into a stream of audible signals; and means for providing the stream of audible signals to a speaker in communication with the converter for producing audible sounds corresponding to the stream of audible signals representative of the information received over the telephone network.

[0016] According to another aspect, the invention provides an apparatus for audibly annunciating at a device information transmitted over a telephone network, the information being transmitted in the form of a modulated signal to the device wherein the modulated signal is representative of the information. The apparatus includes a receiver for capturing a ring signal and a modulated signal representative of information transmitted over a telephone network during an interval between the ring signal and a subsequent ring signal, the receiver providing the subsequent ring signal to a telephone ringer after receiving the modulated signal; a converter in communication with the receiver for converting the modulated signal into a stream of audible signals; and a speaker in communication with the converter for producing audible sounds corresponding to the stream of audible signals representative of the information received over the telephone network.

[0017] Yet another aspect of the invention provides a telephone. The telephone includes an apparatus for audibly annunciating at a device information transmitted over a telephone network, the information being transmitted in the form of a modulated signal to the device wherein the modulated signal is representative of the information. The apparatus includes a receiver for receiving a modulated signal representative of information transmitted over a telephone network during an interval between ringing signals, the receiver providing the subsequent ring signal to a telephone ringer after receiving the modulated signal; a converter in communication with the receiver for converting the modulated signal into a stream of audible

signals; and a speaker in communication with the converter for producing audible sounds corresponding to the stream of audible signals representative of the information received over the telephone network.

[0018] A further aspect of the invention provides a method for audibly annunciating at a device information transmitted over a telephone network, the information being transmitted in the form of a modulated signal to the device wherein the modulated signal is representative of the information. The method includes capturing at a receiver a ring signal from a telephone network; receiving a modulated signal representative of information transmitted over a telephone network during an interval between the ring signal and a subsequent ring signal; converting the modulated signal into a stream of audible signals; providing the stream of audible signals to a speaker in communication with the converter for producing audible sounds corresponding to the stream of audible signals representative of the information received over the telephone network; and providing the subsequent ring signal to a telephone ringer after receiving the modulated signal.

[0019] Still yet another aspect of the invention provides an apparatus for audibly annunciating at a device information transmitted over a telephone network, the information being transmitted in the form of a modulated signal to the device wherein the modulated signal is representative of the information. The apparatus includes means for capturing a ring signal and a modulated signal representative of information transmitted over a telephone network during an interval between the ring signal and a subsequent ring signal, the means for capturing providing the subsequent ring signal to a telephone ringer after receiving the modulated signal; means for converting the modulated signal into a stream of audible signals in communication with the means for capturing; and means for producing audible sounds corresponding to the stream of audible signals representative of the information received over the telephone network in communication with the converter.

[0020] Still a further aspect of the invention provides a telephone. The telephone includes means for audibly annunciating at a device information transmitted over a telephone network, the information being transmitted in the form of a modulated signal to the device wherein the modulated signal is representative of the information. The means for audibly annunciating includes means for receiving a modulated signal representative of information transmitted over a telephone network during an interval between ringing signals, the means for receiving providing the subsequent ring signal to a telephone ringer after receiving the modulated signal; means for converting the modulated signal into a stream of audible signals in communication with the means for receiving; and means for producing audible sounds corresponding to the stream of audible signals representative of the information received over the telephone network in communication with the converter.

[0021] Yet a further aspect of the invention provides a system for audibly annunciating at a device information transmitted over a telephone network, the information being transmitted in the form of a modulated signal to the device wherein the modulated signal is representative of the information. The system includes means for capturing at a receiver a ring signal from a telephone network; means for receiving a modulated signal representative of information transmitted over a telephone network during an interval between the ring signal and a subsequent ring signal; means for converting the modulated signal into a stream of audible signals; means for providing the stream of audible signals to a speaker in communication with the converter for producing audible sounds corresponding to the stream of audible signals representative of the information received over the telephone network; and means for providing the subsequent ring signal to a telephone ringer after receiving the modulated signal.

[0022] These and various other aspects of the invention are pointed out with particularity in the claims annexed hereto and forming a part hereof. For a better understanding of the invention, however, reference should be made to the drawings which form a further part hereof,

and to the accompanying descriptive matter, in which there are illustrated and described specific examples of an apparatus, system and method in accordance with the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] Advantages of the invention may be better understood by referring to the following description taken in conjunction with the accompanying drawings, in which:

Fig. 1 illustrates a related art caller ID system;

Fig. 2 illustrates a related art conventional caller ID unit;

Fig. 3 illustrates one embodiment of a caller ID unit according to the present invention;

Fig. 4 illustrates one embodiment of a caller ID unit according to the present invention;

Fig. 5 illustrates one embodiment of a caller ID system according to the present invention; and

Fig. 6 illustrates one embodiment of a caller ID unit according to the present invention.

DESCRIPTION

[0024] Turning now to the drawings, wherein like reference numerals refer to like elements, the various embodiments of the invention are illustrated as being implemented in a suitable general-purpose environment. In one embodiment, although not necessarily limited to such environment, the invention comprises in the general context an apparatus comprising a text-to-speech converter for audibly annunciating in real-time caller ID information at a device such as, for example, a receiving telephone. In one form, one embodiment of the invention includes a text-to-speech converter unit in combination with a conventional caller ID unit 22.

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[0027] One embodiment of the voice caller ID unit 56, among others, comprises a stand-alone text-to-speech converter 58 such as, for example, a Multi-Lingual Text-to-Speech Processor ML1510, manufactured by OKI SILICON SOLUTIONS COMPANY. The stand-alone text-to-speech converter 58 can provide less complex functionality or more complex functionality than the ML1510 depending on the specific implementation of the invention, without departing from the scope of the invention. For a further description of the ML1510 reference is made to <http://www.oki.com/semi/english/ml1510.htm> (visited November 1, 2001) the contents of which are incorporated herein by reference in its entirety. Those skilled in the art will appreciate, however, that there are a number of off-the-shelf text-to-speech converters that may form a portion of the present invention without departing from its scope.

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[0029] One embodiment of a single chip integrated computer for implementing a text-to-speech converter 58 comprises a central processing unit (CPU) based on, for example, MOTOROLA 6000 series or INTEL 8000 series microprocessors and micro-controllers, and a DAC. Additional varieties of microprocessor and micro-controller architectures that are well known to those skilled in the art can be utilized without limiting the scope of the invention. Also, a custom application specific integrated circuit (ASIC) can be used for implementing the functionality of the text-to-speech 58 without departing from the scope of the invention.

[0030] In one embodiment, a single integrated circuit 59 can be used to combine the caller ID decoding function and the text-to-speech conversion function. Accordingly, in one embodiment the text-to-speech converter 58 and the control circuit 40 can be integrated in a single integrated circuit 59 utilizing conventional integration technology. The integrated circuit 59 as well as the text-to-speech converter 58 can be realized using single-chip computers comprising more advanced microprocessor and micro-controller devices having additional features such as 16 and 32 bit architectures, additional ROM space, dynamic RAM interfaces, 12 bit DACs, serial and parallel interfaces, programmable timers, speech registers, digital signal output registers and the like. In one embodiment, of the single chip computer, the ROM circuit 48 can provide 16K of memory space, the memory circuit 46 can provide 16K or 32K of RAM memory space and so on, depending on the complexity of the executable instructions (firmware) required for a specific embodiment of the invention. Furthermore, a single chip-computer also can include one or more buffers such as, for example, eight buffer slots in a stack and the like.

[0031] In one embodiment, the FSK demodulator circuit 38 also can be integrated in a single-chip integrated circuit to provide an even higher level of integration, thus reducing the size and cost of the voice caller ID unit 56. Those skilled in the art will appreciate that the entire voice caller ID unit 56 can be manufactured as a single integrated circuit including, for example, the telephone line interface circuit 36 and the ringer circuit 51.

[0032] As discussed above the caller ID information relating to the originating telephone device 12 can include the originating telephone number and the name associated with that number that is stored in the directory database 24 in communication with the telecommunication network 16. Those skilled in the art will appreciate that the stream of text characters can be captured at line 57 by the text-to-speech converter 58 which subsequently converts the text characters into a humanly cognizable audible stream of sounds relating to the incoming digitally formatted caller ID information. In operation the caller ID unit 22 receives FSK modulated caller ID signals during an interval between intermittent ringing signals from the central office switch 20. In one embodiment the caller ID information can include, the FSK modulated caller ID signals containing, for example, a channel seizure stream that is followed by a mark stream and then the actual caller ID information. The caller ID information can be sent in a Single Data Message Format (SDMF) containing the calling number or the Multiple Data Message Format (MDMF) containing the calling number and the name associated with that number. The number and name fields may contain additional data for indicating that the caller has blocked the information or that the information is not available. The caller ID information, however, also can include a variety of information especially as local exchange switches and signaling systems become more complex and provide additional features and functionality. Accordingly, the scope of the invention should not be considered to be limited to any specific message, text or character stream format or content.

[0033] The functionality of one embodiment of the text-to-speech converter 58 is generally well known by those skilled in the art. For illustration purposes only, one embodiment of the text-to-speech converter 58 will be described in general terms. Those skilled in the art will appreciate, however, that the invention should not be considered to be limited thereto. Accordingly, in one embodiment the text-to-speech converter 58 can provide one or more levels of text-to-speech synthesis, including converting an electronically formatted text input stream, such as a stream of ASCII characters, and converting the text stream into humanly recognizable

speech comprising sentences, words, phrases and syllables. The conversion process can be implemented by way of custom computation algorithms stored in the ROM circuit 50, for example. When executed the computation algorithm can thus model human speech based on phonemes comprising various syllables and diphones, for example.

[0034] In one embodiment, the speech synthesis also can be based on pre-stored words or phrases, for example. Transitions between phonemes may or may not be considered by the computational algorithm. If not considered, the processing of the phoneme parameters can result in poor quality speech. Therefore, in one embodiment, transitions can be stored in the ROM circuit 50 or the memory circuit 46 to provide a signal between adjacent phonemes, thereby joining two halves of the two separate phonemes into a single combination, generally referred to as a diphone, for example. The diphones can be utilized to generate a speech signal by the superposition of other diphones on phonemes in a similar way that natural speech is achieved. In one embodiment the speech can be achieved by a synthesis based on syllables, words or phrases at the cost of additional memory requirements. See for example, <http://www.oki.com/semi/english/ml1510.htm> (visited November 1, 2001).

[0035] Fig. 4 illustrates one embodiment of a voice caller ID unit 62. As illustrated therein, one embodiment of the voice caller ID unit 62 generally includes the addition of the text-to-speech converter 58 to an existing conventional caller ID unit 22 by tapping the output line 57 of the control circuit 40 that passes the stream of text characters to the display 42. Accordingly, the stream of text characters is routed to the display 42 and is simultaneously routed to the text-to-speech converter 58, thus providing a synthesized humanly recognizable speech output at the speaker 60 as well as a visual output at the display 42.

[0036] Fig. 5 illustrates one embodiment of a system 70 for audibly announcing caller ID information and illustrating one environment for the voice caller ID unit 62. As described hereinbefore, the central office switch 20 transmits information relating to a calling telephone device 12 that originates a call to a first receiving telephone device 14. The call propagates

through a telecommunication network 16 providing a connection between a first central office switch 18 to which the calling telephone device 12 is connected and a second central office switch 20 to which the first receiving telephone device 14 is connected. The first receiving telephone device 14 is shown herein connected to the voice caller ID unit 62, which is separate and detached from the telephone device 14. Another example includes a second receiving telephone device 64 having an integral voice caller ID unit 62. The second receiving telephone device 64 receives ring signals from the central office switch 20 and modulated caller ID information relating to, for example, the originating telephone device 12 and passes these signals through the telephone circuitry of the second receiving telephone device 64 to the voice caller ID unit 62.

[0037] In contrast, there is a third type of receiving telephone device 65 that includes an integral voice caller ID unit 63 for receiving the ring signals as well as the modulated caller ID information. Accordingly, the third receiving telephone device 65 can be utilized to capture the first ring and then capture the entire modulated caller ID information stream before passing the first ring signal to the third telephone device 65. In one embodiment, the third telephone device 65 can be adapted to operate in a GSM environment (GSM stands for Groupe Speciale Mobile, also known as Global System for Mobile Communication). Accordingly, ring signals are passed directly to the voice caller ID unit 63 rather than directly to the third telephone device 65. The voice caller ID unit 63 traps the ring signals, thus keeping the third telephone device 65 quiet while the voice caller ID unit 63 receives all of the caller ID information. The voice caller ID unit 63 releases the ring signals to the third telephone device 65 once it has received the entire stream of caller ID information, for example. The caller ID information is then processed through the voice caller ID unit 63 that outputs an audible annunciation of the caller ID information. The ring circuit 51 can be used to output the ring signal to the telephone device 65 when the control circuit 40 enables it via the address decoder 49, for example.

[0038] Turning now to Fig. 6, where one embodiment of a voice caller ID unit 72 is illustrated. In one embodiment, the voice caller ID unit 72 can be used in conjunction with an advanced call-waiting service for annunciating a number while the user is already using the telephone device 74. The voice announcement can provide standard caller ID information in addition to the caller's telephone number over the voice caller ID unit 72. The internal hardware connection for implementing one embodiment of the voice caller ID unit 72 is similar to the hardware currently provided with the advanced caller ID hardware. With the conventional caller ID display 42 the user can re-display the message from a call in order to re-read it, for example, while with the voice caller ID unit 72 the user can re-route the audible speech signal to the speaker in the telephone's 74 handset.

[0039] In one embodiment, the audio channel output 76 of the text-to-speech converter 58 can be routed to an existing telephone line within a facility or residence and re-route the audio channel output 76 from the text-to-speech converter 58 to the telephone's 74 handset or a speaker phone 80 of another telephone within the building or residence. Routing the audio signal back into the telephone's 74 handset may require, for example, one or more matching networks 78 having a high enough impedance to preserve the audio signal. One example of a matching network 78 that may be incorporated can be found in a product sold by BELL SOUTH normally referred to as a privacy director. The privacy director seizes the incoming call and routes it to a recording machine that plays a prerecorded announcement stored therein. The privacy director then connects to the number that has just called and plays back the recording. Because there is no other audio path the privacy director makes use of a bridge tap to closes the path to the incoming call and opens a path to the recording, for example.

[0040] Those skilled in the art will appreciate that to prevent unwanted annunciations, in the middle of the night for example, the voice caller ID unit 56, 62, 63, 72 can be adapted to work in conjunction with a scheduler. In addition, the voice caller ID unit 56, 62, 63, 72 also can be adapted with an ON/OFF switch to selectively engage the voice caller ID unit 56, 62, 63, 72.

Furthermore, just as with the conventional caller ID unit 22, those skilled in the art will appreciate that the voice caller ID units 56, 62, 63, 72 can be filtered to block calls originating from certain numbers, or permit calls originating only from a list of predetermined numbers that can be entered into the memory circuit 46 of the voice caller ID unit 56, 62, 63, 72, for example.

[0041] While several embodiments of the invention have been described, it should be apparent, however, that various modifications, alterations and adaptations to those embodiments may occur to persons skilled in the art with the attainment of some or all of the advantages of the present invention. It is therefore intended to cover all such modifications, alterations and adaptations without departing from the scope and spirit of the present invention as defined by the appended claims.